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THE SILURIAN AND DEVONIAN IN THE SURROUNDINGS OF NEKÉZSENY (SOUTHERNMOST UPPONY MTS, NORTHERN HUNGARY)

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ABSTRACT

The athrogenic and volcanic sequence (Strázsahegy Formation) of the Strázsa-hegy section; at first regarded as Middle Triassic and later assumed to be Lower Devonian (Lochkovian), could be placed into the Middle Devonian. From olistolites within the tuffitic parts of this formation a complete highly fossiliferous Silurian sequence (similar to the Silurian of the Cellon section in the Carnic Alps, and consisting mainly of pelagic micritic limestones, among these also nautiloid limestones) could be reconstructed. The geological evolution of the Uppony Mts from the Upper Ordovician up to the Bashkirian (Middle Carboniferous) is briefly discussed (*Fig. 1 and 2*).

INTRODUCTION

In northern Hungary ORAVECZ, J. (1965) reported a black chert pebble with a *Radiolarian* cross-section in the Gosau conglomerate of Nekézseny as belonging to Silurian. But this spumellarian *Radiolaria* is specifically undeterminable. The first *Silurian conodonts* of northern Hungary were found by KOZUR, H. (in press *a, c*) in lydite pebbles of the Upper Carboniferous Taróf conglomerate of the borehole Nagybátony—324 (NW of Mátra Mts) and of Felsőszőlőköve in the Bükk Mts. But the richest conodont faunas could be found *in the Strázsa-hegy section at Nekézseny* (southernmost Uppony Mts). They are very well preserved (even conodont apparatuses are present) and they belong to the richest Silurian conodont faunas in Middle Europe. *Almost all Silurian conodont zones are present, indicated mostly by their index species.*

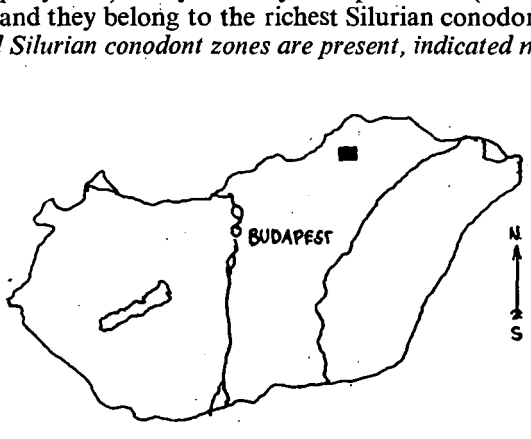

Fig. 1. Location sketch of the Uppony Mts.

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The Strázsa-hegy section yielded also Lochkovian (deeper part of Lower Devonian) conodonts, for the first time reported by KOVÁCS, S. (1981) on the basis of one conodont-bearing sample of the investigated 6 ones. Now rich Lochkovian and more rarely also Pragian, Emsian and Eifelian conodont and ostracod faunas could be found. *The Jőcsös-völgy section* (about 1 km W of the the Strázsa-hegy) yielded Pragian to Lower Eifelian conodonts. One sample (not in situ) yielded also Lochkovian conodonts.

GEOLOGICAL SETTING

The Uppony Mts with its SSE-dipping Paleozoic beds play an important role in the tectonics of northern Hungary. It is regarded as the tectonically separated, slightly metamorphic, stratigraphically downward continuation of the southeastward following Fennsík-nappe of the Bükk Mts with its southalpine—dinaric Middle Carboniferous to Upper Triassic (? and Jurassic) sequence.

Because of scarcity or lack of macrofossils and bad exposures, formerly only hypothesis existed about the precise age of the Uppony Paleozoic. According to SCHRÉTER, Z. (1945, 1960), PANTÓ, G. (1954) and BALOGH, K. (1964) the small Uppony block, surrounded mostly by Neogene deposits, has been assumed to have a more or less continous sequence, beginning in the NW with Devonian (or Tournaisian) deposits and ending in the SE with Viséan ones.

Among the in this time discriminated main units, the light, massive *"Uppony Limestone,,* was placed at first into the Devonian, later into the Lower Tournaisian.

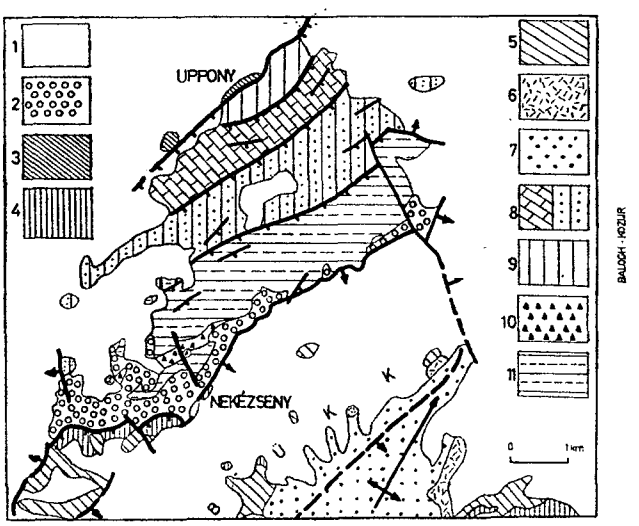

Fig. 2. Geologic sketch of the Uppony Mts.
1: Miocene. *2:* Gosau conglomerate (Senonian). — *Rudabánya Mts: 3:* Lower and Middle Trias. — *Bükk Mts.: 4:* Lower Trias. *5.* Upper Permian. *6:* Middle Permian. *7:* Middle and Upper Carboniferous. — *Uppony Mts.: 8:* "Lázbérc Formation": *a)* Upper Devonian to Tournaisian *(left). b)* Viséan to Lower Bashkirian *(right). 9:* "Uppony Limestone Formation" (partly Middle? Devonian). *10:* Strázsahegy and "Jőcsösvölgy" Formations (mainly Middle Devonian. *11:* "Tapolcsány Formation" (age undetermined).

① Strázsa-hegy section. ② Jőcsös-völgy section

The overlying>1200 m thick "*Limestone—Shale* sequence" was regarded as Upper Tournaisian. The third unit (= "*Tapolcsány Formation*") built up of grey sandstones and shales with some black cherts, manganese lenses and subordinately diabases and their tuffes, was assumed to be Viséan.

KOZUR, H.—R. MOCK (1977) found Upper Devonian conodonts in the tuffitic part of the "Limestone—Shale sequence". But another parts of this complex (now named as "Lázbérc Formation" yield Lower Carboniferous to Lower Bashkirian conodonts; thus it can be divided into two tectonic units. After KOVÁCS's personal communication also the "Uppony Limestone" (considered earlier as a coherent, unfossiliferous sequence) can be divided into several tectonic slices, one of which contains Viséan conodonts, and only the remaining light limestones may belong to the (Middle ?) Devonian.

The nearly unmetamorphic "Nekézseny Limestone" and the accompanied basic volcanics (=today *Strázsahegy Formation*) was regarded by SCHRÉTER and BALOGH as northwestward overthrusted wedges of Bükk Triassic. KOVÁCS, S. (1981) and KOVÁCS, S.—E. VETŐ-ÁKOS (1983) placed it into Lochkovian (lower part of Lower Devonian). The Strázsahegy Formation can only be found in the southernmost Uppony Mts in small wedges tectonically separated from the "*Tapolcsány Formation*". Both formations are transgressively overlain by the Senonian Gosau Conglomerate.

All the former authors regarded the various rocks of the *Strázsahegy section* as contemporaneous deposits. But new artificial outcrops show that the Strázsahegy Formation consists here of altered diabases, limy diabase tuffs (schalstein) with some small limestone and altered diabase inclusions further diabase tuffites with large amounts of limestone blocks that are — according to the here presented conodont data — all olistolites mostly considerably older than the tuffitic matrix. These olistolites are highly fossiliferous and only partly altered by hematite metasomatosis.

In the Jőcsös-völgy section a limestone wedge occurs that is to a large part metasomatically altered. This is the Jőcsösvölgy Formation by KOZUR, H. The Strázsahegy Formation of Jőcsösvölgy consists of tuffites with small limestone olistolites from the underlying Jőcsösvölgy Formation.

STRATIGRAPHICAL RESULTS

In general samples of about 1 kg were taken. Only from small olistolites samples of about 0.2—0.7 kg were solved and the weight of the ostracoda-bearing sample *Sh 19* was about 5 kg. In the Silurian often more than 500 conodonts/kg were found. In the Lower Devonian the conodont frequencies decreases to fewer than 100 specimens/kg. Only in the basal Pragian sample *Ne 4* more than 1000 specimens/kg were present, but only two species. The conodont content of the samples is listed in Table 3.

Among other (rare) microfossils mostly *ostracods* and *fish remains* were found. *Scolecodonts* (only in Přidolian). *Muellerisphaerida* (microfossils of incertae sedis, only in the Lochkovian) and *graptolite* remains (only in the Lochkovian) are extremely rare.

Both the Silurian and Lower Devonian limestones are partly rich in macrofaunas. In the Silurian above all *orthocone nautiloids, brachiopods,* more rarely *pelecypods, crinoids* and very rarely *corals* could be found. In the Lower Devonian large *crinodi stem fragments,* higher up also *corals* are frequent. *Brachiopods* and *pelecypods* are rare.

Strázsa-hegy section:

If not other data are given, the samples are olistolites from the tuffitic part of the Strázsahegy Formation.

Sample Sh 1: Brownish-red nodular nautiloid limestone (0.2 kg). *Age:* The occurrence of *Kockelella variabilis* (WALLISER) without *Polygnathoides siluricus* BRANSON et MEHL indicates the *Kockelella variabilis* zone (Lower Ludlowian).

Sample Sh 2: Pink micritic nautiloid limestone. *Age:* Upper Ludlowian *Ozarkodina crispa* zone indicated by the index species.

Samples Sh 2a, Sh 3, Sh 16, Sh 16a, Sh 18: Pink micritic limestone, in sample *Sh 16* with few nautiloids. The sample *Sh 16a* is more light-grey to almost white and it derives from the upper part of the same olistolite as for sample *Sh 16* (lower part of this olistolite). The sample *Sh 18* is more red-coloured. *Age:* Upper Ludlowian (*Ozarkodina bohemica* to *O. crispa* zones). There is no index species, but huge amounts of *Ozarkodina excavata* (BRANSON et MEHL) are present, partly together with several *Panderodus* species. This very rich occurrence and absolute dominance of *O. excavata excavata* (BRANSON et MEHL) is characteristic for the Upper Ludlowian.

Samples Sh 4: Dark grey micritic to sparitic limestone with some brachiopods and large crinoid stem fragments. *Age: Panderodus praesemicostatus* KOZUR occurs in the Upper Lochkovian and Lower Pragian. *Pandorinella frankenwaldensis* (BISCHOFF et SANNEMANN) is characteristic for the *Ancyrodelloides deltus* zone of Middle to Upper Lochkovian. Therefore an Upper Lochkovian age (deeper part of Lower Devonian) is indicated.

Sample Sh 5 (=sample 3 by KOVÁCS, S. 1981): Dark-grey micritic limestone with some crinoid stem fragments, brachiopods and pelecypods. *Ostracoda,* very rarely *graptolite fragments* and *Muellerispaerida (Armstrongisphaera upponyensis* KOZUR*)* are also present. — *Age:* Upper *Ancyrodelloides deltus* zone indicated by the joint occurrence of *A. deltus* KLAPPER et MURPHY and *A. asymmetricus* (BISCHOFF et SANNEMANN). Upper Lochkovian.

Sample Sh 6: Dark-grey to black marly crinoid-bearing limestone with greenish tuffites. *Age:* Lower *Ozarkodina sagitta* zone (*rhenana* subzone) indicated by the joint occurrence of *P. sagitta* (WALLISER) and *Dapsilodus sparsus* BARRICK that does not occur above the lower *O. sagitta* zone. Middle Wenlockian.

Sample Sh 8: Reddish, a little nodular limestone (0.5 kg). *Age:* The conodont fauna consists almost exclusively of single cone conodonts (mostly *Decoriconus* COOPER). Such faunas are typical to the Middle Wenlockian.

Sample Sh 9 (immediately above a mark *A 3*): Black to grey micritic limestone with some crinoid stem fragments. *Age: Ancyrodelloides omus* MURPHY et MATTI characterizes the lower part of the *Ancyrodelloides deltus* zone (Middle Lochkovian.)

Sample Sh 10 (3 m SE of the mark *A 3*): Light-grey limestone with single large crinoid stem fragments. *Age: Pelekysgnathus serratus serratus* JENTZSCH occurs mostly in the Pragian, but it was rarely reported also from the higher Lochkovian.

Sample Sh 11: Light grey limestone with pebbles that consist of ferruginous limestone, greenish-grey calcareous sandstone, greenish siltstone and acidic tuff. *Age: Pterospathodus pennatus pennatus* (WALLISER) from the matrix characterizes the middle to higher *Pterospathodus celloni* zone of higher Llandoverian.

Sample Sh 12: Grey limestone with reddish fissure fillings. *Age:* Lower *Ozarkodina sagitta* zone (*rhenana* subzone) indicated by the index species both of the zone and the subzone. Middle Wenlockian.

Sample Sh 13: Dark-grey limestone; *sample Sh 30:* coarsely sparitic limestone with large crinoid stem fragments. *Age: Icriodus solatericrescens—Ozarcodina*

zone *(= Ancyrodelloides deltus* zone*)* indicated by the occurrence of *Ozarcodina repetitor* (CARLS et GANDL). Middle to Upper Lochkovian.

Sample Sh 14: Inclusion in the schalstein. Coral-bearing limestone with *Multisolenia* cf. *tortuosa* FRITSCH (determined and placed into the Llandoverian by KOVALEVSKIJ and TESAKOVA). Because the Wenlockian is only represented by pelagical limestone in the Strázsa-hegy section, a Llandoverian age is tentatively assumed.

Sample Sh 15: Small inclusion of crinoidal limestone in the schalstein (0.25 kg). *Age:* Only very few badly preserved conodonts *(Ancyrodelloides* sp., *Ozarkodina cf. remscheidensis)* indicate an early Lower Devonian (Lochkovian) age.

Sample Sh 19: Yellow-brownish-grey crinoid and coral bearing sparitic limestone (5 kg). *Age:* Only ostracods. Similar strongly carinate *Kozlowskiella* species occur only in the Upper Emsian (topmost Lower Devonian) and Middle Devonian.

Sample Sh 20: Grey micritic limestone (0.4 kg). *Age: Ozarkodina remscheidensis* (ZIEGLER) indicates Lower to Middle Lochkovian.

Sample Sh 22: Dark-grey limestone, partly marly, with some juvenile pelecapods *(? Cardiola)* and brachiopods (2 kg). *Age: Polygnathus siluricus* zone (Middle Lochkovian) indicated by the index species.

Sample Sh 23: Greenish-grey micritic limestone with pink spots, slightly tuffitic (0.7 kg); *sample Sh 28:* dark, partly black, micritic, somewhat marly brachiopod-bearing limestone with some greenish tuffites. *Age: Ozarkodina excavata inflata* (WALLISER) and *O. excavata posthamata* (WALLISER) are both restricted to the upper part of the *Ancyrodella plockensis* zone. Topmost Lower Ludlowian.

Sample Sh 23a: Crinoidal limestone. *Age:* The exclusive occurrence of typical *Ozarkodina remscheidensis* (ZIEGLER) indicates Lower Lochkovian.

Sample Sh 24: Grey micritic limestone (0.6 kg). *Age:* Upper *Ozarkodina sagitta* zone (*bohemica* subzone) indicated by the occurrence of *Ozarkodina sagitta bohemica* (WALLISER). Upper Wenlockian to basal Ludlowian.

Sample Sh 25: Light-grey sparitic limestone (0.4 kg). *Age:* Only *Belodella devonica* (STAUFFER) is present, but very frequent. Tis species is long-ranging, but large amounts of the species without any other conodonts seems to indicate Lower Devonian.

Sample Sh 26: Coral-bearing limestone (0.2 kg). *Age: Ozarkodina buchanensis* (PHILIP) indicates basal Pragian.

Sample Sh 29: Light-grey micritic limestone. *Age: Ancyrodelloides asymmetricus* (BISCHOFF et SANNEMANN) indicates the upper part of *Ancyrodelloides deltus* zone. Upper Lochkovian.

Sample Sh 31: Yellow-grey micritic limestone (0,5 kg). *Age: Ozarkodina stygia* (FLAYS), morphotype δ, *O. pandora* MURPHY; MATTI et WALLISER and *Panderodus praesemicostatus* KOZUR occur in the higher *Ancyrodelloides* deltus zone and in the lower *Pedavis pesavis — Pandorinella optima* zone. Upper Lochkovian.

Sample Sh 32: Iron-bearing limestone. *Age: Belodella devonica* (STAUFFER) is moderately frequent. No other conodonts. A Lower Devonian age is probably.

Sample Sh 34: Small grey limestone inclusion in the schalstein, marginally contact metamorphically altered (0.12 kg). *Age:* The conodont association with *Polygnathus angustipennatus* BISCHOFF et ZIEGLER and *P. linguiformis* HINDE indicates the *Tortodus kockelianus* to basal *Polygnathus xylus ensensis* zone of Middle to Upper Eifelian (Middle Devonian).

Sample Sh 35: Light-grey sparitic limestone with some crinoid stem fragments (0.2 kg). *Age: Ozarkodina eosteinhornensis* zone indicated by its index species.

Sample Sh 36: Brownish-red nodular limestone (0.3 kg). *Age: Hadrognathus patulus* zone indicated by the index species. Lower Wenlockian.

Sample Sh 37: Grey limestone with large crinoidal stem fragments and some corals. *Age:* Basal Pragian indicated by *Ozarkodina buchanensis* (PHILIP) and *Belodella striata* KOZUR.

Sample Sh 28: Coral-bearing limestone. *Age:* No microfossils. The corals indicate most probably higher part of Lower to Middle Devonian.

Jőcsös-völgy section:

Sample Ne 4: Grey micritic limestone. Lower part of the non-metasomatical limestone. *Age:* Basal Pragian indicated by *Ozarkodian buchanensis* (PHILIP) and *Belodella striata* KOZUR.

Sample Ne 5: Grey sparitic crinoidal limestone, higher part of the limestone sequence. *Age: Panderodus semicostatus* TIEGLER et LINDSTRÖM indicates Upper Emsian (topmost Lower Devonian) to Lower Eifelian (basal Middle Devonian).

Sample Ne 8: Grey crinoidal limestone with large crinoid stem fragments, collected from debris. *Age:* Some *Ancyrodelloides fragments* indicate the *A. deltus* zone of Middle to Upper Lochkovian.

Sample Ne 9: Bulk sample of several very small limestone olistolites within the tuffite of the sample Ne 9a. Grey micritic limestone (0.08 kg). *Age:* Because of the small amounts of available rock only some conodonts could be founad, but the fauna with *Belodella striata* KOZUR seems to indicate basal Pragian.

Sample Ne 9a: Crinoid and coral-bearing tuffite with small olistolites. *Age:* Among corals *Heliolites* is present. This genus ends in the top of the Middle Devonian. Therefore these tuffites cannot be younger than Middle Devonian.

Sample Ne 12: Dark-grey sparitic limestone. *Age:* Basal Pragian indicated by *Ozarkodina buchanensis* (PHILIP).

Samples Ne 15—20: Reddish to brownish coral limestones and coral-algal limestones. *Age:* There are no microfossils for an exact age determination. The corals with *Heliolites* indicate higher Lower Devonian to Middle Devonian, but they had to be still investigated by coral specialists for more precise age determinations.

4. GEOLOGICAL EVOLUTION IN THE PALEOZOIC OF THE UPPONY MTS

According to the Tables 1 and 2 the oldest fossil-dated rocks belong to the *Upper Llandoverian.* This fauna derives from the matrix of a limestone olistolite with unfossiliferous pebbles (above all greenish-grey calcareous sandstone) that may represent Upper Ordovician. Also a coral limestone is tentatively assigned to the Llandoverian. The missing evidence of Lower Llandoverian olistolites may either result from the scarcity of Llandoverian olistolites or may be caused by a gap that could be indicated by the pebbles of older rocks within the Upper Llandoverian olistolite.

On the contrary to the Llandoverian *the Wenlockian* and *Ludlowian* is well documented by olistolites. These consist of red to pink, grey, greenish-grey and black, mostly micritic limestones and nautiloid limestones (the latter ones are sometimes nodular) and dark-grey to black marly limestones (Table 1). The presence of black shales, not preserved as olistolites, may be assumed from olistolites of black marly limestones to marls that could be found within the lower *O. sagitta* zone (Middle Wenlockian) and in the *O. siluricus zone* (Middle Ludlowian). The *ostracode* faunas

TABLE 1

Silurian sequence from the Strázsa-hegy at Nekézseny reconstructed from olistolites within higher Emsian to Middle Devonian tuffites. Comparison with the Silurian of the Cellon section (Carnic Alps)

Carnian Alps	Strázsa-hegy	Conodont zone	Age
Megaerella Beds (light, partly fossiliferous limestones)	Light, partly fossiliferous limestones	*Ozarkodina eosteinhornensis*	Přidolian
Alticola Limestone (grey and pink nautiloid limestones)	Grey and pink limestones and nautiloid limestones	*O. crispa*	Ludlowian
		O. snajderi	
Cardiola Beds (black limestones and shales)	Dark grey limestones ank marls	*P. siluricus*	
Kok Limestone (brownish ferruginous nodular limestone)	Greenish-grey limestones with ferruginous spots, brownish to reddisch-brownish ferruginous nodular limestone and nautiloid limestone	*K. variabilis* I / II	
		O. sagitta III / IV	Wenlockian
Trilobite and Aulacopleura Beds (alternating shales and ferruginous limestone beds)	Grey limestones with intercalations of reddish-brownish ferruginous limestones, black marly limestones	*Hadrognathus patulus*	
	* Light gray limestone with pebbles	*P. amorphognathoides*	
		P. celloni	Llandoverian
Lower Beds and Uggwa Limestone Formation	Not fossil-proven	Bereich I	Ordovician

I = *Ancoradella ploeckensis* zone; II = *Ozarkodina crassa* zone; III = *Ozarkodina sagitta bohemica* subzone; IV = *Ozarkodina sagitta rhenana* subzone

* The pebbles consist of ferruginous limestone, greenish-gray calcareous sandstone, greenish siltstone and subordinately acidic tuff.

from the Wenlockian and Ludlowian limestones indicate water depth of about 50—150 m.

A certain tectonic unrest is indicated by fissure fillings of reddish limestones in grey ones. These are typical for tensional tectonic activity or indicate block faulting. Weak synsedimentary basic volcanism can be traced in Wenlockian and Lower Ludlowian limestones by some minor greenish tuffite intercalations within the limestone olistolites.

TABLE 2

Lower and Middle Devonian sequence of the Uppon Mts

Upper Devonian		Grey, rarely reddish bedded limestones, nodular limestones, tuffs, subordinately shales
Givetian	Strázsa-hegy Formation	Diabases and schalstein with limestone inclusions; Tuff, tuffite with limestone olistolites; Uppony Limestone Formation: massive, light reef limestone; Light to dark grey limestone
Eifelian		
Emsian		
Siegenian	Pragian	Jőcsös-völgy Formation: Grey to yellowish coral-bearing and crinoidal limestones
Gedinnian	Lochkovian	Light to dark gray, mostly sparitic, partly also micritic limestone and crinoidal limestone
Silurian		

In the highest Silurian *(Přidolian)* the water depth decreases and the pelagic micritic limestones are partly displaced by shallow water crinoid-brachiopod limestones. In the *Lochkovian* the geological situation is similar compared with the Přidolian, but shallow water crinoid-brachiopod limestones prevail over dark micritic limestones. No traces of volcanism could be found in the Lochkovian olistolites within the Strázsahegy Formation.

In the *Pragian* the shallowing of the depositional area continued: crinoidal and coral limestones were deposited. Only in some of these beds conodonts are still present. The *ostracods* indicate maximum water depth of about 20 m, but mostly fewer. No traces of volcanic activities.

The environmental conditions were unchanged during the *Emsian,* but for the Upper Emsian the beginning of the volcanism can not be excluded. Namely the fauna of the olistolites within the tuffitic part of the Strázsahegy Formation indicates an Upper Emsian to Middle Devonian age. Likewise in the higher Jőcsös-völgy Formation below the tuffites an *Upper Emsian* to *Lower Eifelian* conodont fauna could be found. Therefore *the tuffites cannot be older than uppermost Emsian, but most probably they belong to the Middle Devonian.*

For the schalstein and altered diabases above the tuffites and tuffs the oldest age can be more exactly determined. An inclusion within the schalstein yielded Middle to Upper Eifelian conodonts. *The schalstein and diabases have therefore most probably a*

TABLE 3

Distribution of the conodonts in the samples of Strázsa-hegy and Jőcsös-völgy near Nekézseny

Conodont species	Sh 1	Sh 2	Sh 2a	Sh 3	Sh 4	Sh 5	Sh 6	Sh 8	Sh 9	Sh 10	Sh 11	Sh 12	Sh 13	Sh 16	Sh 16a	Sh 18	Sh 19	Sh 20	Sh 22	Sh 23	Sh 23a	Sh 24	Sh 25	Sh 26	Sh 28	Sh 29	Sh 30	Sh 31	Sh 32	Sh 34	Sh 35	Sh 36	Sh 37	Ne 4	Ne 5	Ne 9	Ne 12
Ancyrodelloides asymmetricus (BISCHOFF et SANNEMANN)						+																				○										
Ancyrodelloides deltus (KLAPPER et MURPHY)						○																														
Ancyrodelloides cf. *omus* (MURPHY et MATTI)									○																											
Ancyrodelloides transitans (BISCHOFF et SANNEMANN)									○																○											
Ancyrodelloides sp. indet.						○																														
Belodella devonica (STAUFFER)		○	+	+	○			+		+		+	+		○		○	+		○			×					○	+			○	○	×		+	+
Belodella erecta (RHODES et DINELEY)					×					×																×		+								
Belodella silurica BARRICK												○								○																
Belodella striata KOZUR																																	○	+		○	
Dapsilodus obliquicostatus (BRANSON et MEHL)							+					○										○														
Dapsilodus praecipuus BARRICK											○																									
Dapsilodus sparsus BARRICK							+					○																								
Dapsilodus sp.												○																				○				
Dapsilodus sp. sensu BARRICK, 1977							○	○																												
Decoriconus fragilis (BRANSON et MEHL)							×	×				×										○										+				
Decoriconus magnistriatus KOZUR																									○											
Decoriconus sp.								×																												
Hadrognathus patulus (WALLISER)																																○				
Kockelella variabilis WALLISER	○																		+																	
Neopanderodus hungaricus KOZUR									○																											
Neopanderodus sp.																																		○		○	
Ozarkodina buchanensis (PHILIP)																							+											+			○
Ozarkodina confluens (BRANSON et MEHL)																																○					
Ozarkodina cf. *crassa* (WALLISER)																									○											
Ozarkodina crispa (WALLISER)		○																																		
Ozarkodina eosteinhornensis (WALLISER)																																○				
Ozarkodina excavata excavata (BRANSON et MEHL)	+	+	×	×				○						×	×	×			×	×					×											
Ozarkodina excavata inflata (WALLISER)																				○					○											
Ozarkodina excavata posthamata (WALLISER)																				○					○											
Ozarkodina orta WALLISER							+																													
Ozarkodina pandora MURPHY; MATTI et WALLISER						×																						+								
Ozarkodina remscheidensis (ZIEGLER)																		+			+															
Ozarkodina repetitor (CARLS et GANDL)						○			○				○													×	○	⊙								
Ozarkodina cf. *sagitta* (WALLISER)							○																													
Ozarkodina sagitta bohemica (WALLISER)																						○														
Ozarkodina sagitta rhenana (WALLISER)												○																								
Ozarkodina sagitta sagitta (WALLISER)												×																								
Ozarkodina stygia (FLAYS)																										×		○								
Ozcrkodina wurmi (BISCHOFF et SANNEMANN)																										×										
Ozarkodina cf. *wurmi* (BISCHOFF et SANNEMANN)					○																							○				○	+			
Ozarkodina sp.										+																	○									
Ozarkodina sp. indet.																									○											
Panderodus barricki KOZUR	○	×	○																○	×					○											
Panderodus gracilis (BRANSON et MEHL)		×	○	○							○	+								+												○				
Panderodus praesemicostatus KOZUR					○	○																				+		+								
Panderodus recurvatus densistriatus KOZUR											×	+													○								○				'
Panderodus recurvatus recurvatus (RHODES)	○	+															+		○	×																
Panderodus semicostatus ZIEGLER et LINDSTRÖM																																			○		
Panderodus simplex (BRANSON et MEHL)			○	○					○		+	○								+																
Panderodus spasovi DRYGANT								○				○																					○				
Panderodus unicostatus (BRANSON et MEHL)		×	+	+				○				+								+													+				
Panderodus n. sp. *A*																	○																				
Panderodus n. sp. *B*																		○																			
Panderodus n. sp. *C*																		○																			
Panderodus sp. indet.					○				○											○							○							○			
Pandorinella frankenwaldensis (BISCHOFF et SANNEMANN)						○																				○										
Pandorinella sp.										○																											
Pelekysgnathus serratus JENTZSCH										○																											
Polygnathoides emarginatus (BRANSON et MEHL)																									○											
Polygnathoides siluricus BRANSON et MEHL																			+																	
Polygnathus angustipennatus BISCHOFF et ZIEGLER																														○						
Polygnathus linguiformis linguiformis HINDE																														+						
Pseudooneotus beckmanni (BISCHOFF et SANNEMANN)						×		○	○			○						○							○			○								
Pseudooneotus tricornis DRYGANT											○																									
Pterospathodus pennatus pennatus (WALLISER)											○																									

× = very frequent; + = moderately frequent ○ = rare

Givetian (or topmost Eifelian). The upper age range could be only determined for the tuffites that contain *Heliolites* unknown above the Middle Devonian.

Thus we can say that after a quiet time in the Lower Devonian, the Middle Devonian was a time of tectonic and volcanic activity. The depositional area of the Uppony Mts was now subdivided in ridges and basins and the whole area subsided slowly. On the subsiding ridges thick pure (probably reef-) limestones of the "Uppony Limestone Formation" were deposited. In the basinal parts light to dark-grey conodont-bearing limestones, but on the slopes limestones with reef detritus settled down. The third heteropic facies in the Middle Devonian was represented by the volcanic and athrogenic Strázsahegy Formation. In connection with the Middle Devonian volcanic activity huge slide masses of Silurian and Lower Devonian limestones sliped into the basins where tuffs and tuffites were deposited nearly contemporaneously with the diabases and schalstein. — The Upper Devonian consisted of limestones, shales, tuffs and tuffites.

During the Lower Carboniferous to basal Bashkirian basinal limestones and shales settled down. The overlying Tapolcsány Formation consisting of a flyschoid sequence of shales, aleurolites, strongly pressed sandstones, siliceous shales and black cherts with ferromanganese nodules includes olistolites of Middle and Upper Devonian and Lower Carboniferous limestones in some places (e. g. at the cliff Éleskő; *Plate 7: 4)*. Also some Lower Bashkirian conodonts were found in the beds adjacent to the fossiliferous Lower Carboniferous. But for lack of sufficient determinable microfossils the exact age of the bulk of the Tapolcsány Formation is still unknown. Thus it is also possible that it shall be devided in the future into divers stratigraphic and tectonic units.

As pointed out by KOZUR, H.—R. MOCK (1977) and KOVÁCS, S.—H. KOZUR—R. MOCK (1983) no stratigraphic gaps are known in the Uppony Mts from the Middle Devonian up to the Bashkirian. So the effects of the older phases of Hercynian orogenesis could net be strong. The slightly epimetamorphic character of the Middle Devonian—Bashkirian sequence in the northern part of the mountains (ÁRKAI, P., 1983) can be explained by the existence of tectonic slices that underwent an alpine metamorphosis of different degree. *It is possible,* however, *that the tectonic slices of the almost unmetamorphic Silurian to Bashkirian at Nekézseny* (at the south margin of the Uppony Mts) *belong geologically to the Bükk Mts.* These tectonic slices were thrusted on the Uppony Mts before the deposition of the Gosau beds. The Carboniferous, Permian and Triassic sequences of the immediately southward following parts of the northern Bükk Mts are likewise only weakly affected by alpine metamorphosis.

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REFERENCES

ÁRKAI, P. (1983): Very low- and low-grade Alpine regional metamorphism of the Paleozoic and Mesozoic formations of the Bükkium, NE-Hungary. — Acta Geol. Hung., **26**, 83—101, Budapest

BALOGH, K. (1964): Die geologischen Bildungen des Bükk-Gebirges. — Jahrb. Ungar. Geol. Anstalt, **48**, 2. 245—719, Budapest.

BALOGH, K. and G. PANTÓ (1954): Recherches géologiques dans les environs de Nekézseny. — MÁFI évi jel. **1953,** 1, 17—27, Budapest.
ERBEN, H. K. (1962): Unterlagen zur Diskussion der Unter) Mitteldevon-Grenze. — *In:* Sympos. 2. Internat. Arbeitstag. über die Silur/Devon-Grenze und die Stratigr. von Silur und Devon, Bonn—Bruxelles, 1960, 62—70, Stuttgart.
ERBEN, H. K. and K. ZAGORA (1968): Devonian of Germany. — *In:* OSWALD, D. H. (ed.): Internat. Sympos. Devonian System, Calgary, 1967, **1,** 53—68, Calgary.
FÜLÖP, J. *et al.* (1983): Magyarország litosztratigráfiai formációi. — Budapest.
KLAPPER, G. and W. ZIEGLER (1979): Devonian conodont biostratigraphy. — *In:* The Devonian System. — Spec. Paper in Paleont., **23,** 199—224. London.
KOVÁCS, S. (1981): Lower Devonian conodonts from the Strázsa-hegy, near Nekézseny; Uppony Mts., North Hungary. — MÁFI évi jel. **1979,** 65—79, Budapest.
KOVÁCS, S., H. KOZUR and R. MOCK (1983): Relations between the Szendrő—Uppony and Bükk Paleozoic in the light of the latest micropalaeontological investigations. — MÁFI évi jel. **1981,** 155—175, Budapest.
KOVÁCS, S. and É. VETŐ-ÁKOS (1983): On the age and petrology of the basic volcanics in the Uppony Mts, NE Hungary. — MÁFI évi jel. **1981,** 177—199, Budapest.
KOZUR, H. (in press *a*): On the age and tectonical significance of the prae-Oligocene sequence of the water exploration bore hole Nagybátony 324. — Földt. Közlöny, Budapest.
KOZUR, H. (in press *b*): Fossilien aus dem Silur von Ungarn (vorläufige Mitteilung). — Proc. Geoinst., Beograd.
KOZUR, H. (in press *c*): Biostratigraphic evaluation of Upper Paleozoic conodonts, ostracods and holothurian sclerites of the Bükk Mts. Part I. Conodonts and holothurian sclerites of the Upper Moskowian and Upper Carboniferous. — Acta Geol. Hung., Budapest.
KOZUR, H. (in press *d*): *Muellerisphaerida* n. ord., eine neue Ordnung von Mikrofossilien unbekannter systematischer Stellung aus dem Silur und Devon von Ungarn. — Geol. Paläont. Mitt., Innsbruck.
KOZUR, H. and R. MOCK (1977): On the age of the Paleozoic of the Uppony Mountains (North Hungary). — Acta Miner. Petr., Szeged, **23,** 1, 91—107.
PANTÓ, G. (1954): Le levé des gîtes métalliques dans la montagne de Uppony. — MÁFI évi jel. **1952,** 91—111, Budapest.
SCHÖNLAUB, H. P. (1979): Das Paläozoikum in Österreich. — Abhandl. Geol. B.—A., **33,** 124 p. Wien.
SCHRÉTER, Z. (1945): Geologische Aufnahmen im Gebiete von Uppony, Dédes und Nekézseny, ferner im Gebiete von Putnok. — MÁFI évi jel. **1941—42,** 1, 161—237, Budapest.
SCHRÉTER, Z. (1960): Die geologischen Verhältnisse des Bükkgebirges. — Karszt- és Barlangkutatás, **1,** 7—36, Budapest.
WALLISER, O. H. (1964): Conodonten des Silurs. — Abh. hessisch. L. Anst. Bodenforsch., **41,** 106 p., Wiesbaden.
WEDDIGE, K. (1977): Die Conodonten der Eifelstufe im Typusgebiet und in benachbarten Faziesgebieten. — Senckenberg. Letaea. **58,** 4/5, 271—419, Frankfurt a. M.
ZIEGLER, W. (1979): Historical subdivision of the Devonian. — *In:* The Devonian System. — Spec. papers in Palaeontol., **23,** 23—47, London.

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EXPLANATION OF PLATES

Plate I

All figured conodonts are from Silurian limestone olistolites within the tuffitic part of the Middle Devonian Strázsahegy Formation. Strázsa-hegy section at Nekézseny.

1: *Panderodus simplex* (BRANSON et MEHL), conodont apparatus, lateral view, sample Sh 12, grey limestone with brownish-red fissure fillings, lower *Ozarkodina sagitta* zone *(rhenana subzone),* Middle Wenlockian, ×160, rep.-no. S 9

2: *Decoriconus fragilis* (BRANSON et MEHL), sample and age as for fig. 1, ×200, rep.-no. S 103
3: *Panderodus recurvatus densistriatus* KOZUR, obverse side, sample and age as for fig. 1, ×150, rep.-no. S 90
4; 6: *Ozarkodina sagitta sagitta* (WALLISER), sample and age as for fig. 1, ×120, *fig. 4:* rep.-no. S 14, *a)* upper view, *b)* lateral view; *fig. 6:* upper view, rep.-no. S 13
5: *Ozarkodina sagitta rhenana* (WALLISER), lateral view, sample and age as for fig. 1, ×150, rep.-no. S 108
7: *Dapsilodus obliquicostatus* (BRANSON et MEHL), sample Sh 6, dark bluish-grey to black, crinoid-bearing, micritic and marly limestone with greenish tuffitic intercalations, *Ozarkodina sagitta* zone (Wenlockian), ×160, rep.-no. S 109

Plate II

All figured conodonts are from Silurian and Lower Devonian limestone olistolites within the tuffitic part of the Middle Devonian Strázsa-hegy Formation. Strázsa-hegy section at Nekézseny.

1, 2: *Decoriconus fragilis* (BRANSON et MEHL), 2 different elements, sample Sh 6, dark bluish-grey to black crinoid-bearing micritic and marly limestone with greenish tuffitic intercalations, *Ozarkodina sagitta* zone (Wenlockian), ×200, rep.-no. S 110 (fig. 1) and S 117 (fig. 2)
3: *Polygnathoides siluricus* BRANSON et MEHL, upper view, sample Sh 22, dark grey to black, partly marly limestone, *Polygnathoides siluricus* zone (Middle Ludlowian), ×32, rep.-no. S 10
4: *Panderodus recurvatus recurvatus* (RHODES), reverse side, sample Sh 2, pink micritic nautiloid limestone, *Ozarkodina crispa* zone (Upper Ludlowian), ×100, rep.-no. S 122
: *Ozarkodina sagitta bohemica* (WALLISER), sample Sh 24, grey limestone, upper part of *Ozarkodina sagitta* zone (*bohemica* subzone), Upper Wenlockian to basal Ludlowian ×150, rep.-no. S 8
6: *Neopanderodus hungaricus* KOZUR, reverse side, sample Sh 9, grey crinoidal limestone, deeper part of *Ancyrodelloides deltus* zone (Middle Lochkovian, deeper part of Lower Devonian), ×130, rep.-no. D 509
7: *Kockelella variabilis* WALLISER, upper view, sample Sh 1, brownish-red nodular nautiloid limestone, *Kockelella variabilis* zone (Lower Ludlowian), a 150, rep.-no. S 12

Plate III

All figured conodonts are from the Strázsa-hegy section at Nekézseny.

1: *Ozarkodina confluens* (BRANSON et MEHL), sample Sh 35, olistolite of light grey, sparitic crinoid-bearing limestone, *Ozarkodina eosteinhornensis* zone (Přidolian), ×72, rep.-no. S 99
3: Carinate *Kozlowskiella* sp., Strázsa-hegy at Nekézseny, sample Sh 19, olistolite of yellow-brownish-grey crinoidal-coral limestone within the tuffitic part of the Strázsahegy Formation, ×44, rep.-no. D 539

4: *Palmatolepis* cf. *P. tenuipunctata* SANNEMANN, eastern bank of the Uppony reservoir, olistolite within the Tapolcsány Formation, Lower Famennian, ×78, rep.-no. D 544

2: *Polygnathus angustipennatus* BISCHOFF et ZIEGLER, sample Sh 34, limestone inclusion in the Middle Devonian schalstein, *Tortodus kockelianus* to basal *Polygnathus xylus ensensis* zone (Middle to Upper Eifelian), ×60, rep.-no. D 501, *a)* upper view, *b)* lateral view

3: *Ozarkodina crispa* (WALLISER), juvenile specimen, anterior part of blade broken away, sample Sh 2, olistolite of pink, micritic nautiloid limestone within the tuffitic part of the Middle Devonian Strázsahegy Formation, *Ozarkodina crispa* zone (Upper Ludlowian), ×320, rep.-no. S 119

4: *Ozarkodina excavata inflata* (WALLISER), sample Sh 23, olistolite of greenish-grey micritic limestone with pink spots, slightly tuffitic, within the tuffitic part of the Strázsahegy Formation, upper part of *Ancoradella ploeckensis* zone (topmost Lower Ludlowian), ×130, rep.-no. S 112, *a)* upper view, *b)* lateral view

5: *Dapsilodus obliquicostatus* (BRANSON et MEHL), sample Sh 24, olistolite of grey limestone within the tuffitic part of the Strázsahegy Formation, upper part of *Ozarkodina sagitta* zone (*bohemica* subzone), Upper Wenlockian to basal Ludlowian, ×100, rep.-no. S 118

Plate IV

All figured conodonts are from limestone olistolites within the tuffitic part of the Strázsahegy Formation; Strázsa-hegy section at Nekézseny.

1, 2: *Ozarkodina excavata excavata* (BRANSON et MEHL); *fig. 1:* lateral view, sample Sh 3, pink micritic limestone, Upper Ludlowian, ×100, rep.-no. S 120; *fig. 2:* lateral view a little obliquely from above, sample Sh 16, pink micritic limestone with some nautiloids, Upper Ludlowian, ×72, rep.-no. S 102

3: *Panderodus barricki* KOZUR, obverse side, sample Sh 23, greenish-grey micritic limestone with pink spots, slightly tuffitic, upper part of *Ancoradella ploeckensis* zone (topmost Lower Ludlowian), ×130, rep.-no. S 21

4, 6: *Ozarkodina remscheidensis* (ZIEGLER), sample Sh 23a, grey sparitic crinoidal limestone, Lower Lochkovian; *fig. 4:* lateral view, ×86, rep.-no. D 523; *fig. 6:* upper view, ×60, rep.-no D 524

5: *Ancyrodelloides asymmetricus* (BISCHOFF et SANNEMANN), sample Sh 29, light grey micritic limestone, upper part of *Ancyrodelloides deltus* zone (Upper Lochkovian), ×180, rep.-no. D 527, *a)* a little oblique upper view, *b)* lateral view

Plate V

All figured conodonts are from the Strázsa-hegy section at Nekézseny.

1: *Ancyrodelloides asymmetricus* (BISCHOFF et SANNEMANN), sample Sh 5, olistolite of dark grey crinoid and brachiopod-bearing limestone within the tuffitic part of the Strázsahegy Formation. Upper part of *Ancyrodelloides deltus* zone (Upper Lochkovian, rep.-no. D 526, *a)* upper view, ×48, *b)* lateral view, ×44

2: *Ozarkodina pandora* MURPHY; MATTI et WALLISER, lateral view, sample and age as for fig. 1, ×100, rep.-no. D 525

3: *Ozarkodina repetitor* (CARLS et GANDL), sample Sh 31, olistolite of yellow-grey micritic limestone within the tuffitic part of the Strázsahegy Formation, upper part of Ancyrodelloides deltus zone to lower part of *Pedavis pesavis — Pandorinella optima* zone (upper Lochkovian, ×150, rep.-no. D 533

4: *Polygnathus linguiformis linguiformis* HINDE, upper view, sample Sh 34, limestone inclusion in the schalstein, *Tortodus kockelianus* to basal *Polygnathus xylus ensensis* zone (Middle to Upper Eifelian), ×72, rep.-no. D 502

5: *Pelekysgnathus serratus serratus* JENTZSCH, lateral view, sample Sh 10, light grey limestone with few crinoid remains, olistolite within the tuffitic part of the Strázsahegy Formation. Higher Lochkovian to Pragian (deeper to middle part of Lower Devonian), ×150, rep.-no. D 541

6: *Ozarkodina stygia* (FLAYS), sample Sh 29, light grey micritic limestone, olistolite within the tuffitic part of the Strázsahegy Formation. Upper part of *Ancyrodelloides deltus* zone (Upper Lochkovian), ×200, rep.-no. D 542, *a)* lateral view, *b)* upper view

Plate VI

1, 2: *Belodella striata* KOZUR, Jőcsös-völgy near Nekézseny, sample Ne 4, grey micritic limestone, basal Pragian, *fig. 1:* denticulated element, rep.-no. D535, *á)* detail of upper part, ×480, *b)* detail of middle part, striation well visible, ×360, *c)* complete specimen, ×78; *fig. 2:* undenticulated element, striation well visible, ×150, rep.-no. D 504

Plate VII

1: *Panderodus* sp., obverse side, probably transitional form between *P. praesemicostatus* KOZUR and *P. semicostatus* ZIEGLER et LINDSTRÖM, Strázsahegy at Nekézseny, sample Sh 4, olistolite of dark grey micritic to sparitic limestone with few large crinoid stem fragments and brachiopods, probably Pragian (middle part of Lower Devonian), ×84, rep.-no. D 543

2: *Panderodus semicostatus* ZIEGLER et LINDSTRÖM, obverse side, Jőcsös-völgy near Nekézseny, sample Ne 5, grey sparitic crinoidal limestone, Upper Emsian to Lower Eifelian, rep.-no. D 522, *a)* detail from the middle part of the specimen, ×300, *b)* complete specimen, ×94

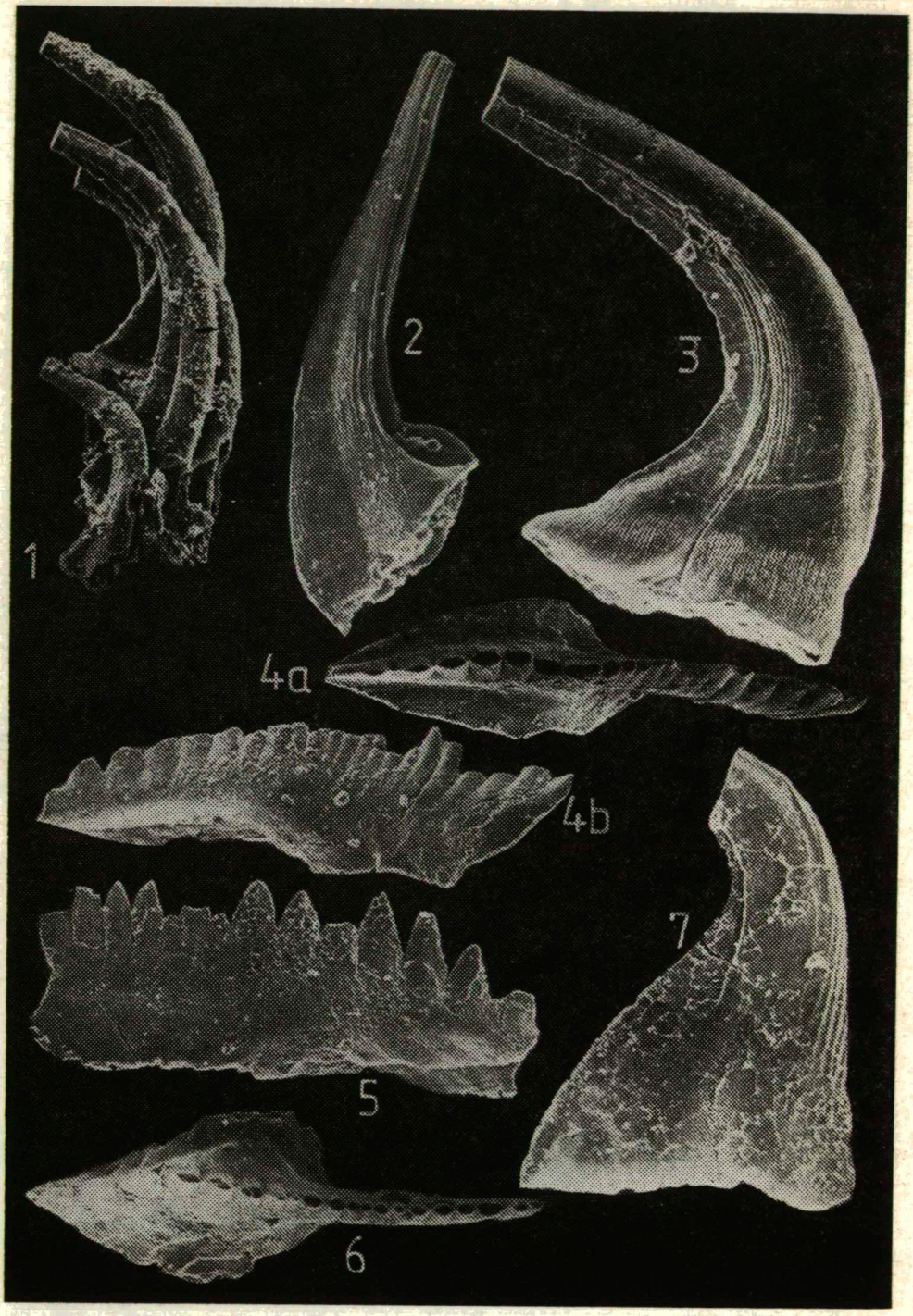
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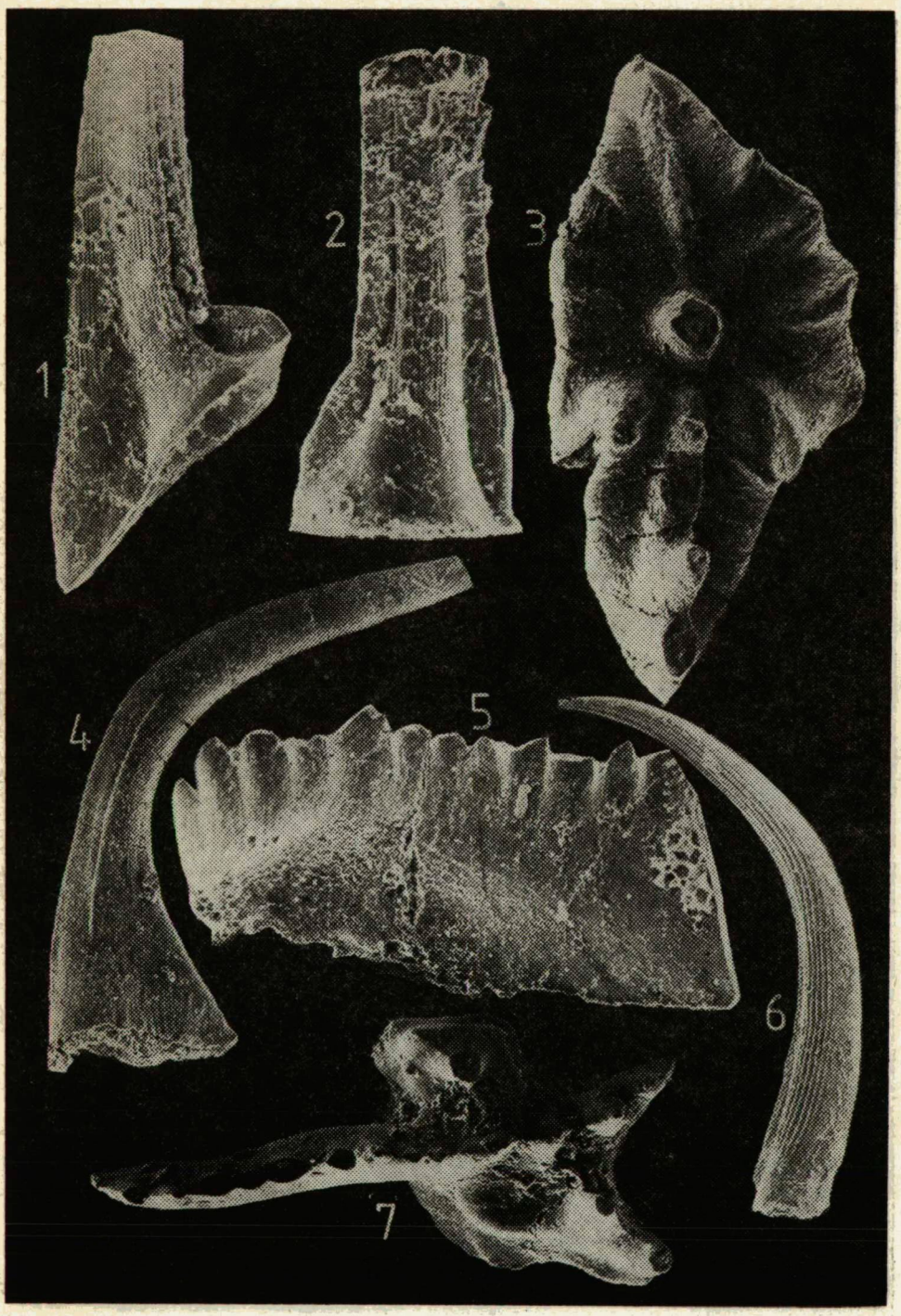
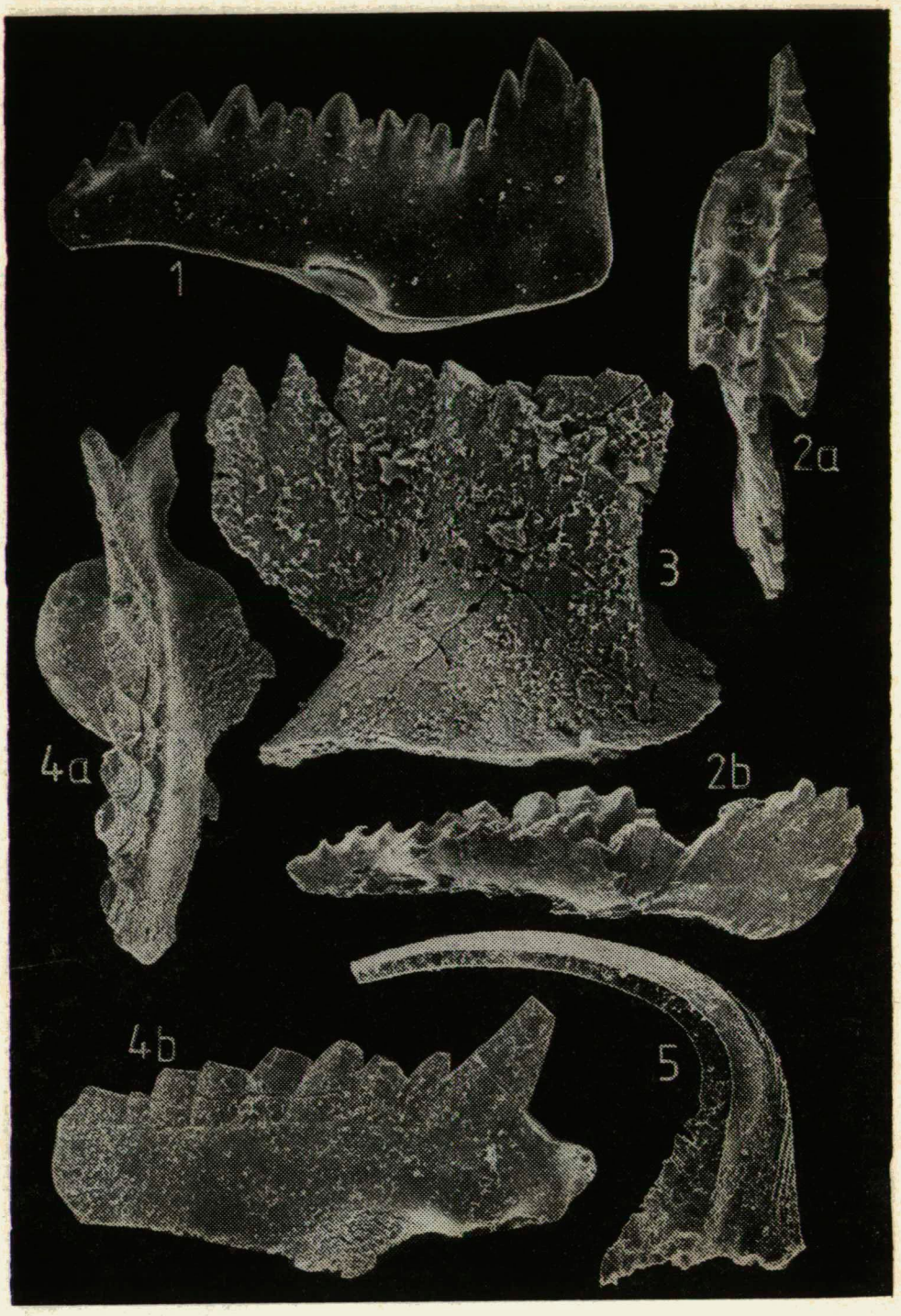
Plate II

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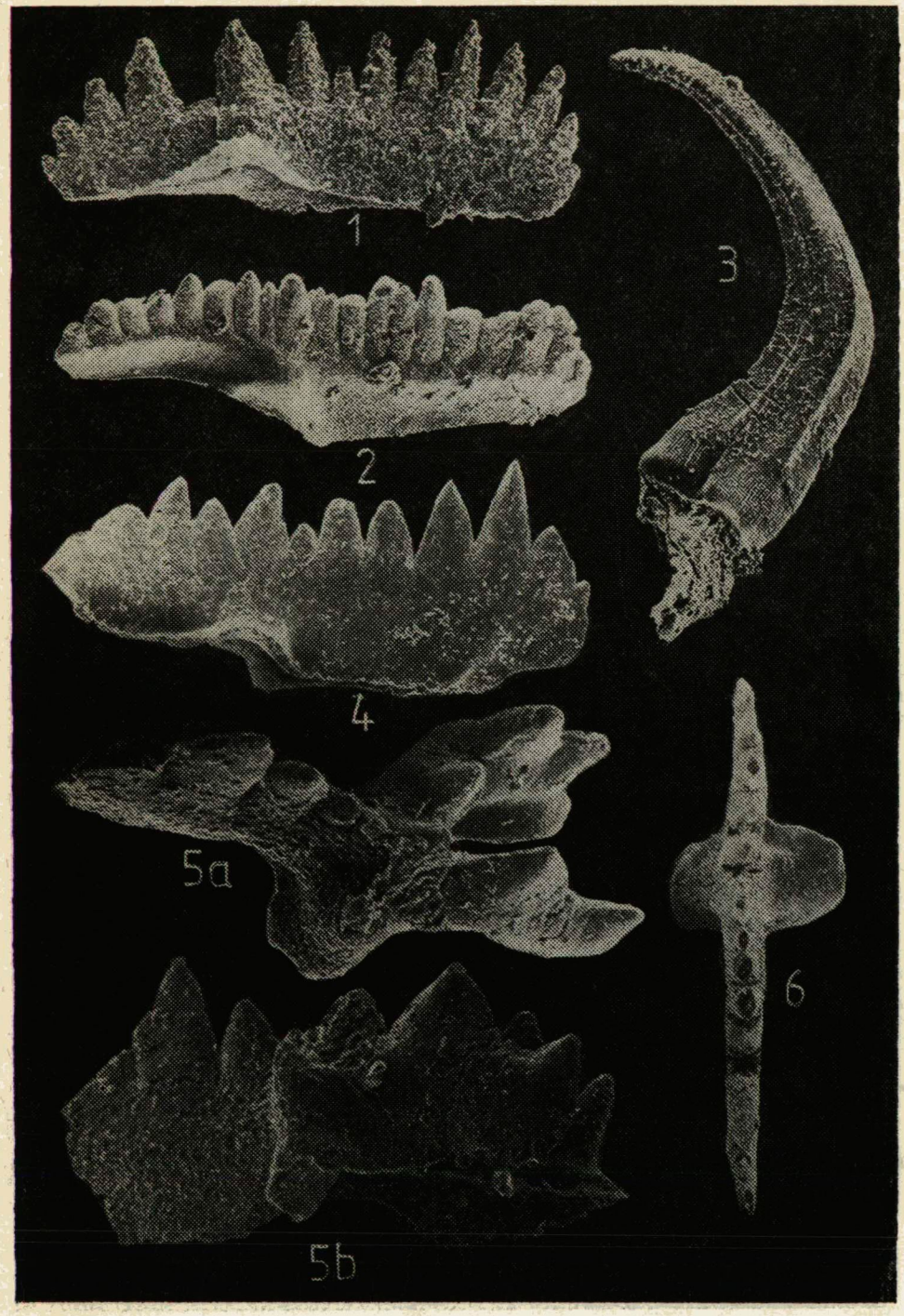
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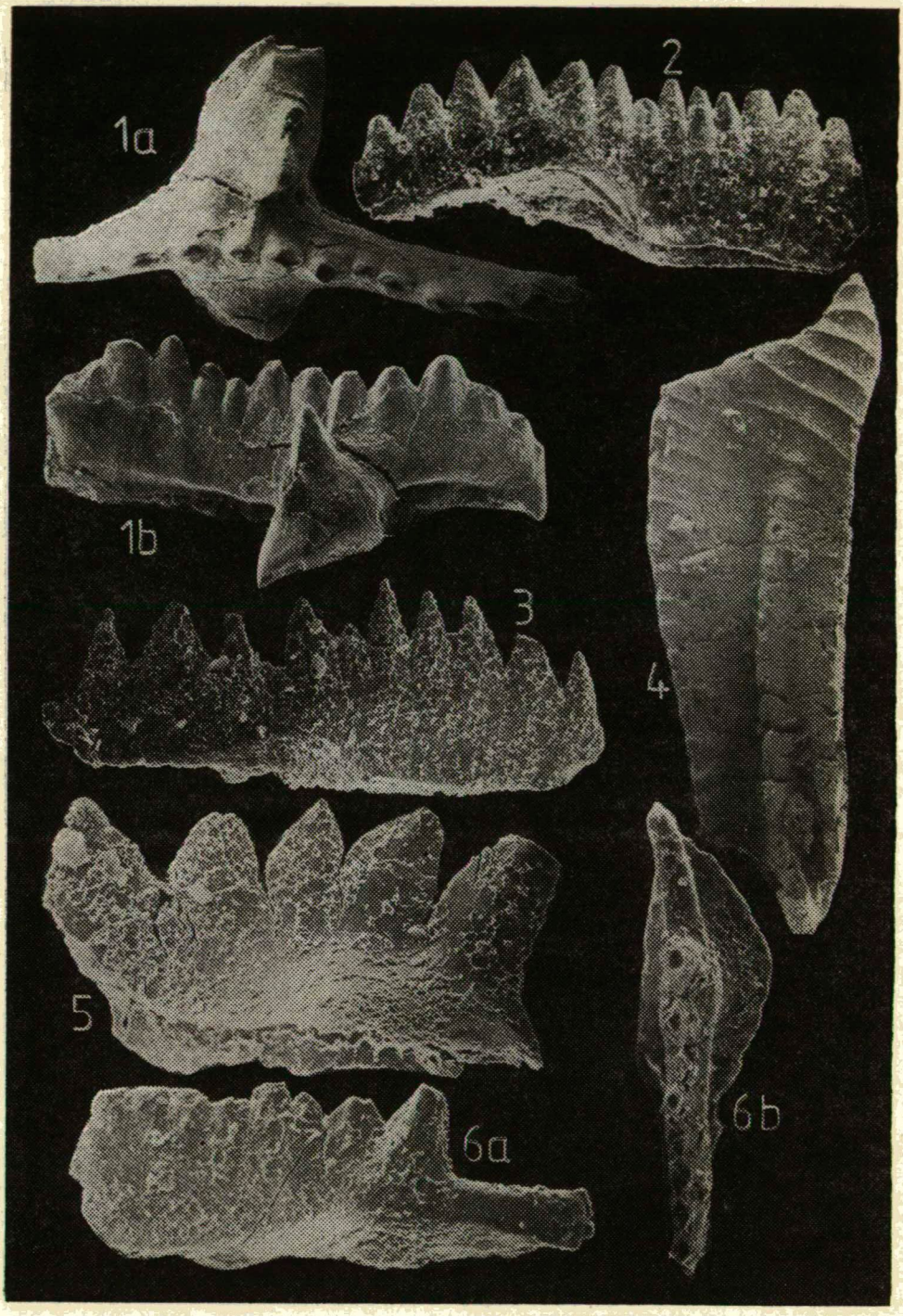
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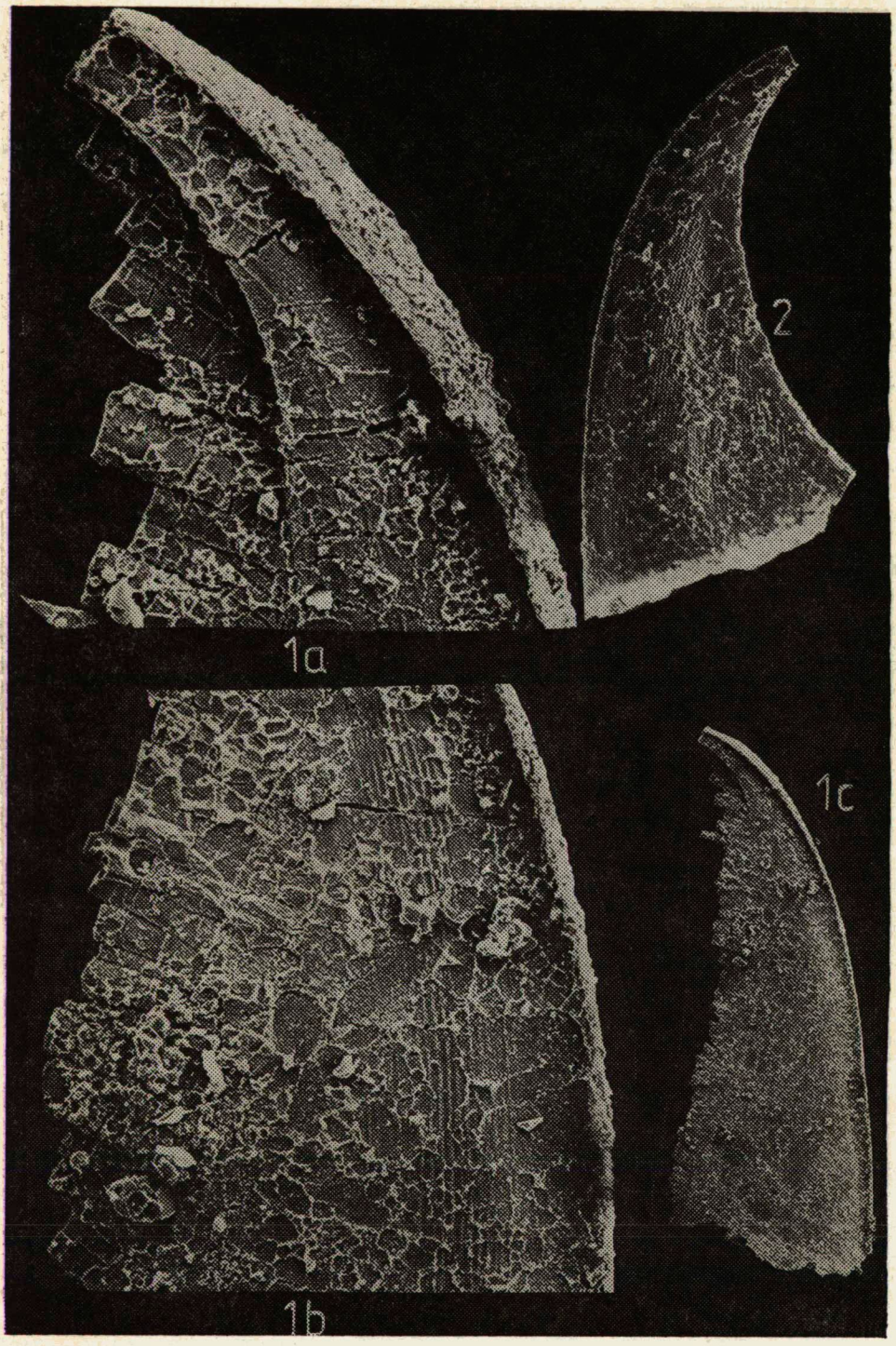
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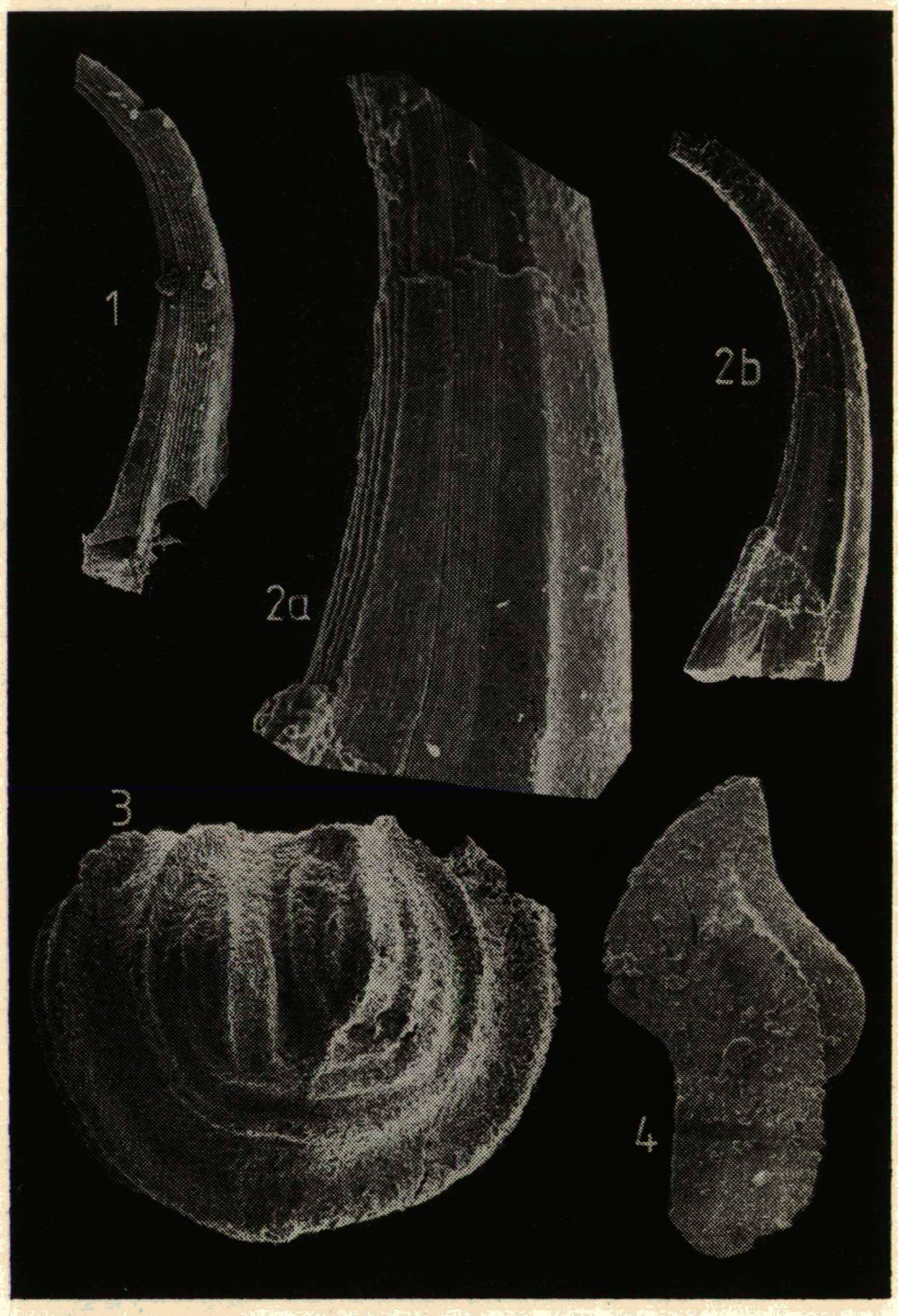
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